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EXAMINER	
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ART UNIT	PAPER NUMBER
1753	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	02/20/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No. 10/777,800	Applicant(s) BECKER ET AL.	
	Examiner Rodney G. McDonald	Art Unit 1753	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *20 November 2006*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-14,17-27,29-31 and 33-41* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-14,17-27,29-31 and 33-41* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1-9, 11-13, 18-25, 27, 29-31 and 33-36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yakshin et al. (US PGPUB. 2004/0245090 A1) in view of Carcia et al. (U.S. Pat. 6,756,161) and Kureishi et al. (U.S. Pat. 6,740,208).

Regarding claims 1, 6, 27, Yakshin teach a method of manufacturing a multilayer for the extreme ultraviolet wavelength range. (See Abstract; paragraph 0001) Yakshin teach applying layers by ion beam sputtering. The multilayer materials that can be deposited include Mo, Si, Ru, C, B, Rb, Rh, Sr, Y, Cr, Sc or components thereof. (See paragraph 0016; 0033; Claim 1) (Inherently ion beam sputtering includes a target in a

vacuum chamber, a first particle beam to sputter the target, and a substrate to capture the sputtered target material)

Regarding claim 2, Yakshin teach ion beam sputtering which inherently includes a first particle beam directed onto a target and sputtered particles emerging form the target in a direction toward the substrate. (See paragraph 0016; 0033; Claim 1)

Regarding claims 3, 27, Yakshin teach depositing at least a second layer of a second material by ion beam sputtering to produce EUV multilayers. (See Abstract; paragraph 0016; 0033; Claim 1)

Regarding claims 7, 27, Yakshin teach irradiating the substrate by use of a second particle beam. (Paragraph 0020, 0017)

Regarding claims 9, 24, Yakshin teach utilizing the first and second particle beam as ion beams. (See paragraph 0033; 0020)

Regarding claim 21, Yakshin et al. teach that at least one layer of the multilayer system is deposited without ion beam assistance and is irradiated with ions after being deposited. (Page 2 paragraph 0026) Yakshin et al. teach that the process achieves a smoothing effect. (i.e. flattening). (Page 2 paragraph 0017)

Regarding claim 22, Yakshin et al. teach that after at least one layer has been deposited the layer is further irradiated with ions for some period of time before proceeding with the next layer. (Page 3 Claim 5) Here the Examiner interprets at least one to include more than one layer or multiple layers. Yakshin et al. teach that the layers are smoothed. (i.e. flattened) (Page 2 paragraph 0017)

Regarding Claims 23, 27, Yakshin et al. teach smoothing the layers for effecting the reflectivity of the layers. (See Abstract)

Regarding claims 29, 30, Yakshin et al. teach an extreme ultraviolet mask blank. (See Yakshin et al. discussed above)

Regarding claim 31, Yakshin et al. teach treating with a second particle beam. (See paragraph 0020)

Regarding claim 36, Yakshin et al. teach an extreme ultraviolet mask. (paragraph 0001)

The differences between Yakshin et al. and the present claims is that the structure of an ion beam sputtering chamber with ion assistance is not discussed (claims 1, 2), adjusting the angle of incidence of the sputtering target atoms to optimize the film stress to be about 0.2 MPa or less is not discussed (Claims 1, 29, 30), the target defining a target normal line and the first particle beam hitting the target under an angle to the target normal line is not discussed (Claim 4), the substrate defining a substrate normal line and sputtered particles form the target hit the extreme ultraviolet mask blank under an angle to the substrate normal line is not discussed (Claim 5), the rate of deposition is not discussed (Claim 6), the substrate defining a substrate normal line and the second particle beam hitting the extreme ultraviolet mask blank under an angle to the substrate normal line is not discussed (Claim 8), the first and second particle beams are separately controlled independently depositing layers by the first particle beam and treating at least one of the substrate and the layers by the second particle beam is not discussed (Claim 11), the first and the second particle beams

comprise different particles is not discussed (Claim 12), the first and second particle beams have different particle energies is not discussed (Claim 13), wherein at least one of the layers is doped by irradiating with the second particle beam is not discussed (Claim 18), the layers being differently doped is not discussed (Claim 19), controlling parameters by doping is not discussed (Claim 20), utilizing a Xe ion beam is not discussed (Claims 25, 27), the grain size is not discussed (Claim 30), the surface roughness is not discussed (Claim 33), a light reducing layer is not discussed (Claim 34) and the layer comprising an anti-reflective layer is not discussed (Claim 35).

Regarding the structure of an ion beam sputtering chamber with ion assistance (Claims 1, 2), Carcia et al. teach in Fig. 1 providing a substrate 4 and a target 2 in a vacuum chamber where the process pressure is kept from 10^{-3}-10^{-5} Torr. A first particle beam is provided from a deposition gun 1. Ions from gun 1 sputter the target to deposit a film on the substrate 4. A Cr film can be deposited for example. (Column 4 lines 13-49) Carcia et al. teach that irradiating by a second ion beam from an assist gun 6. (Column 4 lines 13-49)

Regarding adjusting the angle of incidence of the sputtering target atoms to optimize the film stress to be about 0.2 MPa or less (Claims 1, 29, 30), Carcia teach that in a dual ion beam deposition ***the angles between the target, the substrate, and the ion guns can be adjusted to optimize for film uniformity and film stress***. (Carcia et al. Column 2 lines 41-44) Kureishi et al. teach that for fabricating a mask the ion beam assist gun can be controlled such that the mask can have a stress of zero. (Kureishi et al. Column 3 lines 46-59).

Regarding claim 4, Carcia et al. teach in Fig. 1 a target with a normal line and the first particle beam hitting the target under an angle to the target normal line. (See Fig. 1)

Regarding claim 5, Carcia et al. teach in Fig. 1 a substrate normal line and sputtered particles (i.e. Si) from the target hit the photomask blank under an angle to the substrate normal line. (See Fig. 1)

Regarding claim 6, Carcia et al. teach that the deposition rate can be greater than 0.1 nm/min. (Column 4 lines 45-47)

Regarding claim 8, Carcia et al. teach in Fig. 1 a substrate normal line and the second particle beam hitting the photomask blank at an angle to the substrate normal line. (See Fig. 1)

Regarding claim 11, Carcia et al. teach that the ion guns 1 and 6 are both separately controlled to have different levels of energy with the assist ion beam gun producing ions with a lower energy than that of the deposition ion gun 1. (Column 4 lines 53-59)

Regarding claims 12, Carcia et al. teach that the deposition ion gun can utilize inert gas and that the assist ion gun can utilize reactive gases. (Column 4 lines 13-42)

Regarding claim 13, Carcia et al. teach that the particles of the two ion guns will have different energies. (Column 4 lines 53-59)

Regarding claim 18, Carcia et al. teach that one of the layers can be doped with the second particle beam utilizing reactive gas. (Column 5 lines 24-33; Example)

Regarding claim 19, Carcia et al. teach that multilayers can be deposited with differently doped layers. (Column 5 lines 24-33)

Regarding claims 20, Carcia et al. teach that optical density can be controlled by doping. (Column 6 lines 1-20)

Regarding claims 25, 27, Carcia et al. teach the ion beam can be Xe. (Column 4 lines 18-28)

Regarding the grain size (Claim 30), since Yakshin et al. teach the same process as Applicant's the grain size must be the same. (See Yakshin et al. discussed above)

Regarding the surface roughness (Claim 33), since Yakshin et al. teach the same process as Applicant's the surface roughness must be the same. (See Yakshin et al. discussed above)

Regarding a light reducing layer (Claim 34), Yakshin et al. teach utilizing a carbide material which is a light reducing layer. (See Paragraph 0016)

Regarding the layer comprising an anti-reflective layer (Claim 35), Yakshin et al. teach utilizing a carbide material which is an anti-reflective layer. (See Paragraph 0016)

The motivation for utilizing the features of Carcia et al. is that it allows for producing multilayers with optimized film properties. (Column 4 lines 4-7)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified Yakshin et al. by utilizing the features of Carcia et al. because it allows for optimizing the film properties of the multilayers.

Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yakshin et al. in view of Carcia et al. and Kureishi et al. as applied to claims 1-9, 11-13, 18-25, 27, 29-31 and 33-36 above, and further in view of Campbell et al. (U.S. Pat. 4,885,070).

The difference not yet discussed is wherein at least one of the first and second particle beams comprises an ion beam which is accelerated and focused by an electromagnetic field. (Claim 10)

Regarding claim 10, Campbell et al. teach utilizing electromagnetic coils for restricting the plasma ions in the tubular zone of an ion gun and the target. (Column 5 lines 26-33; Column 8 lines 32-47)

The motivation for utilizing an electromagnetic coil in an ion beam sputtering apparatus is that it allows for restricting the plasma ions in the tubular zone of the ion gun and the target. (Column 5 lines 26-33)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have utilized electromagnets as taught by Campbell et al. because it allows for restricting the plasma ions in the tubular zone of the ion gun and the target.

Claims 14 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yakshin et al. in view of Carcia et al. and Kureishi et al. as applied to claims 1-9, 11-13, 18-25, 27, 29-31 and 33-36 above, and further in view of Scott (U.S. Pat. 4,793,908).

The differences not yet discussed are wherein a surface of the substrate is conditioned by irradiating with the second particle beam is not discussed (Claim 14) and the reactive gas comprising oxygen is not discussed (Claim 17).

Regarding claim 14, Scott et al. teach an IBAD apparatus in which the assist ion beam device conditions the surface of the substrate by smoothing before deposition of the layers. (Column 12 lines 13-16)

Regarding claim 17, Scott et al. teach that oxygen can be utilized in the chamber. (Column 12 lines 60-62)

The motivation for conditioning and cleaning the surface of a substrate with an inert gas and a reactive gas such as oxygen is that it allows for cleaning and smoothing of the substrate. (Column 12 lines 13-16)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have cleaned a surface of the substrate from impurities by irradiating with the second particle beam before deposition of the first layer and wherein at least one reactive gas is provided in the vacuum chamber and the cleaning is enhanced by the at least one reactive gas, conditioned the surface of the substrate, and utilized a reactive gas comprising oxygen as taught by Scott et al. because it allows for cleaning and smoothing of the substrate.

Claim 26 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yakshin et al. in view of Carcia et al. and Kureishi et al. as applied to claims 1-9, 11-13, 18-25, 27, 29-31 and 33-36 above, and further in view of Linkow et al. (U.S. Pat. 4,944,754).

The difference not yet discussed is the pressure during sputtering is not discussed (Claim 26).

Regarding claim 26, Linkow et al. teach a Xenon ion beam for sputtering where the pressure is about 10^{-7} torr. (Column 5 lines 40-43)

The motivation for utilizing the features of Linkow et al. is that it allows for causing ionization of the background gas. (Column 5 lines 40-43)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have utilized the features of Linkow et al. because it allows for causing ionization of the background gas.

Claims 37, 38, 40 and 41 are rejected under 35 U.S.C. 103(a) as being unpatentable over Carcia et al. (U.S. Pat. 6,756,161) in view of Kureishi et al. (U.S. Pat. 6,740,208), Scott (U.S. Pat. 4,793,908) and Kanarov et al. (U.S. Pat. 6,590,324).

Regarding claim 37, Carcia et al. teach a method and apparatus for fabricating a binary photomask blank for selected wavelengths of < 400 nm. (See Abstract) Carcia et al. teach in Fig. 1 providing a substrate 4 and a target 2 in a vacuum chamber where the process pressure is kept from 10^{-3}-10^{-5} Torr. A first particle beam is provided from a deposition gun 1. Ions from gun 1 sputter the target to deposit a film on the substrate 4. A Cr film can be deposited for example. (Column 4 lines 13-49) Carcia et al. teach that the photomask blank is irradiated by a second ion beam from an assist gun 6. (Column 4 lines 13-49)

Regarding claim 38, Carcia et al. teach that both guns 1 and guns 6 can be ion guns. (Column 4 lines 13-49)

Regarding claim 40, Carcia et al. teach that the deposition source and assist particle source are separably controllably be selecting the ion energies of the beams. (Column 4 lines 53-59)

Regarding claim 41, Carcia et al. teach that the two beams can be of different particles and different energies. (Column 4 lines 17-43, lines 54-59)

The differences between Carcia et al. and the present claims is that cleaning a surface of the substrate from impurities by irradiating with the second particle beam before deposition of the first layer and wherein at least one reactive gas is provided in the vacuum chamber and the cleaning is enhanced by the at least one reactive gas (Claim 37), the geometrical orientation of the substrate relative to the target including the angle of incidence of the sputtered target atoms is adjustable to optimize the film stress to about 0.2 MPa (Claim 37) and at least one curved three grid ion extraction assembly together with a controllable radio frequency power is not discussed (Claim 37).

Regarding the cleaning of a surface of the substrate from impurities by irradiating with the second particle beam before deposition of the first layer and wherein at least one reactive gas is provided in the vacuum chamber and the cleaning is enhanced by the at least one reactive gas (Claim 37), Scott et al. teach an IBAD apparatus in which the assist ion beam device conditions the surface of the substrate by smoothing before deposition of the layers. (Column 12 lines 13-16) Scott et al. teach an IBAD apparatus in which the assist ion beam device also cleans the surface of the substrate before depositing a layer. (Column 12 lines 13-16) Scott et al. teach that the assist ion beam

can formed of a mixture of argon, xenon and oxygen gases. (Column 12 lines 60-62) Scott et al. teach that oxygen can be utilized in the chamber. (Column 12 lines 60-62)

The motivation for conditioning and cleaning the surface of a substrate with an inert gas and a reactive gas such as oxygen is that it allows for cleaning and smoothing of the substrate. (Column 12 lines 13-16)

Regarding the geometrical orientation of the substrate relative to the target including the angle of incidence of the sputtered target atoms is adjustable to optimize the film stress to about 0.2 MPa (Claim 37), Carcia teach that in a dual ion beam deposition ***the angles between the target, the substrate, and the ion guns can be adjusted to optimize for film uniformity and film stress***. (Carcia et al. Column 2 lines 41-44) Kureishi et al. teach that for fabricating photomask the ion beam assist gun can be controlled such that the photomask can have a stress of zero. (Kureishi et al. Column 3 lines 46-59).

The motivation for controlling the assist ion beam is that it allows control a stress of the film to be zero so that a sufficient optical density can be obtained. (Column 3 lines 46-59; Column 2 lines 30-32)

Regarding at least one curved three grid ion extraction assembly together with a controllable radio frequency power (Claim 37), Kanarov et al. teach an ion beam source having a three grid ion extraction assembly with a controllable radio frequency power. (Column 6 lines 59-65; Column 7 lines 18-28)

The motivation for utilizing the features of Kanarov et al. is that it allows for reducing problems with the ion beam source. (Column 4 lines 44-46)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have cleaned a surface of the substrate from impurities by irradiating with the second particle beam before deposition of the first layer and wherein at least one reactive gas is provided in the vacuum chamber and the cleaning is enhanced by the at least one reactive gas, conditioned the surface of the substrate, and utilized a reactive gas comprising oxygen as taught by Scott et al. and to have utilized the features of Kanarov et al. because it allows for cleaning and smoothing of the substrate and reducing problems with the ion beam source.

Claim 39 is rejected under 35 U.S.C. 103(a) as being unpatentable over Carcia et al. in view of Kureishi et al., Scott et al. and Kanarov et al. as applied to claims 37, 38, 40 and 41 above, and further in view of Campbell et al. (U.S. Pat. 4,885,070).

The difference not yet discussed is that the use of an electromagnetic field to direct particles is not discussed (Claim 39).

Regarding claim 39, Campbell et al. teach utilizing electromagnetic coils for restricting the plasma ions in the tubular zone of an ion gun and the target. (Column 5 lines 26-33; Column 8 lines 32-47)

The motivation for utilizing an electromagnetic coil in an ion beam sputtering apparatus is that it allows for restricting the plasma ions in the tubular zone of the ion gun and the target. (Column 5 lines 26-33)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have utilized electromagnets as taught by Campbell et

al. because it allows for restricting the plasma ions in the tubular zone of the ion gun and the target.

Response to Arguments

Applicant's arguments filed November 20, 2006 have been fully considered but they are not persuasive.

In response to the argument that Mitsui do not teach a phase shift mask blank or an extreme ultraviolet mask blank, it is argued that Yakshin et al. teach a substrate having mirrors for the extreme ultraviolet wavelength range. Such substrate is construed as a mask blank having the alternate layers for the extreme ultraviolet wavelength range. (See Yakshin et al. discussed above)

In response to the argument that Carcia and Kurieshi do not teach an extreme ultraviolet mask blank, it is argued that Yakshin et al. teach an extreme ultraviolet mask blank as discussed above. (See Yakshin et al. discussed above)

In response to the argument that the prior art does not teach the background pressure, it is argued that Linkow et al. teach Applicant's required pressure range for ionizing the background gas. (See Linkow et al. discussed above)

In response to the argument that the prior art of record does not teach a curved grid ion extraction assembly, it is argued that Kanarov et al. teach a curved grid ion extraction assembly for an ion beam source. (See Kanarov et al. discussed above)

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP

§ 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Rodney G. McDonald whose telephone number is 571-272-1340. The examiner can normally be reached on M- Th with Every other Friday off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam X. Nguyen can be reached on 571-272-1342. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Rodney G. McDonald
Primary Examiner
Art Unit 1753

RM
February 13, 2007